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ABSTRACT

Research involving cognitive modification and using intervention instruction in general prerequisite cognitive processes has shown that significant and long-term results are possible. Use of intervention instruction involving prerequisite data gathering skills with teachers has been successful in improving ability to use probing questions in classroom discussions, giving clear and concise directions, in solving formal operational level problems and involvement of students in decision making. The problem investigated in this study was to determine the effects of intervention instruction in cue attendance on teacher performance in analysis and modification procedures of classroom lesson plans. Included in the intervention instruction and followup lesson plan activities were detail attendance, information search questions, hypothesis generation and designing strategies for hypothesis testing. The 189 participants in the research project, all final-year secondary education majors, were divided into three groups. Each group was given the same experiences except for the treatment variable. Pretesting involved critique of a classroom lesson for one group, a Piagetian Task Assessment for the second, and only introductory remarks for the third group. A detailed description is presented of the assignments, treatment, and treatment rationale for each group. An analysis of the results includes discussion of implications for teacher education techniques. (JD)

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Effects of Intervention Instruction Using Cognitive Modification Techniques on Teacher Perception and Behavior

Dennis W. Sunal

A great deal of discussion over the past five years has involved the low state of teachers' performance and the lack of effective teachers for specific teaching areas. Much of it related to general levels and problems rather than recommending application and analysis of significant effects resulting from current theory and research. The present study was designed to address this inbalance through application of a theoretical framework, which incorporates research knowledge from information processing and developmental theory, to provide an alternative approach for increasing basic skills in classroom teaching.

BACKGROUND

The definition of teaching described here begins with the condition that we cannot specify all situations in which teachers find themselves, nor can we identify all teachers' or students' characteristics which help determine the appropriateness of various approaches. Therefore, we cannot train teachers to use the available skills and methods in a descriptive way that will produce effective teaching. Rather, teaching is best characterized as a condition in which knowledge and skill based judgement and decision-making must be exercised in order to guide the provision of appropriate instruction (National Institute of Education, 1975).

Effective teaching involves many complex behaviors that require effective use of higher level thought processes. The thought processes are similar to the processes used in completing Piagetian performance tasks. Professional teacher education programs have assumed that prerequisite and higher level thought processes are sufficiently developed in pre and inservice teachers so as not to pose a problem in classroom performance. Evidence has accumulated over the past three decades, beginning with Lovell in 1961, that not all adults reach the higher developmental level of thought and action hypothesized by Piaget, Kohlberg, and others. Numerous studies of preservice and inservice teachers found that large segments of this group are not functioning at a level which would allow them to become effective decision makers and exhibit proficient classroom performance (e.g., McKinnon and Renner, 1971, Chiapetta 1976, and Sunal and Sunal 1985).

Over the past 10 years, the work of a number of researchers in preservice and inservice education has implicated general developmental progress (e.g., Oja and Sprinthall 1978, Glassberg and Oja 1981, Lyons 1984a and 1984b) and more specific development of intellectual processes (e.g., Koran, Snow, and McDonald 1970, Nelson and Ankney 1977; Peterson, Marx, and Clark 1978; Martin 1983; and Sunal and Sunal, 1980 and 1985) in teaching performance of classroom teachers. Specific formal level thinking schema which have been related to classroom teaching performance include hypothetical-deductive reasoning, identification and use of

variables, ego-centricism, combinatorial reasoning, and control of variables (Sunal and Sunal 1985).

While it is clear that these mental schema are widely used in classroom teaching performance, it is also understood that these reasoning schema are themselves aggregates of more fundamental cognitive development. They include, among others, concrete operational schema (operational knowledge), contents of thought (figurative knowledge) (Kamii 1976), and cognitive processes which are prerequisite to and relate the formal reasoning schema. Concrete operational schema and contents of thought, developed through course work and field experience, are stressed and highly accomplished in teachers during undergraduate teaching programs. Inability to use formal operational schema in teaching decisions and performance may be due to a lack of schema or deficiencies in prerequisite cognitive processes critical in the use of the schema in the context of some routine and most complex classroom problem situations.

Intervention instruction in formal operational schema or in prerequisite cognitive processes are suggested possible routes to change teaching performance (Bruner, 1961). A third route, that of preservice or inservice education providing knowledge and practice in teaching skills is the dominant path used today to increase teaching effectiveness. However, the success of this dominant mode is seen to be strongly moderated by the teacher's ability to understand the knowledge or skills being taught. In fact, the efficiency of teacher education programs and workshops may be directly correlated to the formal operational thought level of the teacher. Better teaching may result not by changing the teacher education content but by increasing the receptivity and application proficiency of what is taught and learned "while on the job" through intervention cognitive modification procedures.

Considering the first two alternative routes to increasing the teaching effectiveness, intervention training in formal operational schema would appear more long term in transfer effects than cognitive modification through training in prerequisite cognitive processes. The latter hypothesizes the existence of formal schema, at the transitional or early formal thought level, but due to deficiencies in prerequisite abilities to use them, lack of coordination between schema, or immature form of the schema they appear only in certain situations or not at all. To increase the regularity of the use of the formal schema, intervention training in basic cognitive processes may prove to show strongest effects with teachers at the transitional, 2B+, and early formal operational levels, 3A and 3A+. This need, as concluded from a number of studies reported earlier, represents up to two-thirds of preservice teachers and one-half of inservice teachers.

Rather than approaching the relationship of formal operational functioning and teaching effectiveness globally, a more limited focus is needed to develop understanding of the effects. A focus would also provide practical information and procedures useful in potential application to teacher education. One formal operational schema, hypothetical- deductive reasoning, has been cited as critical to effective decision making in planning and carrying out classroom lessons. It serves as a foundation for classroom teaching behaviors such as 1) postulating decisions based on relevant variables derived from professional

education experiences, 2) processing information, making decisions and anticipating problems without experiencing the events first, and 3) using if-then reasoning in postulating solutions verifiable in future classroom observations. (Sunal and Sunal 1985).

Prerequisite cognitive processes, related to data acquisition processing in Information Processing Thoery, are needed for effective hypothetical-deductive reasoning and its integration with other formal schema. The processes make possible the observation, formulation and selection of relevant variables and the consideration of all relevant information in making decisions. For such specific teaching activities as lesson planning and plan analysis where hypothetical-deductive reasoning is needed, the prerequisite processes would involve functional data acquisition processes in at least five areas. They are 1) perception of sufficient and clear sensory data allowing for appropriate distinction and description of objects and events; 2) planned and organized exploratory behavior schema allowing selection of relevant cues with specific characteristics; 3) recognition of the need for collecting all data in exploratory behavior and use of a wide range of precise data to describe relevant variables; 4) ability to distinguish relevant cues in defining variables relating to a problem; 5) efficiency of memory space storage and retrieval of sufficient level that an appropriate number of units can be accessed and manipulated at the same time.

Research involving cognitive modification and using intervention instruction in general prerequisite cognitive processes has been conducted. This research has shown significant and long-term results with adolescents and adults. Savell, Twohig, and Rachford (1986) report that intervention involving a general program, the Feuerstein Instrumental Enrichment method, designed for improving problem solving strategies has been successful in increasing adolescent cognitive functioning (eg. Haywood and Burke 1977, Feuerstein 1980, and Shayer and Beasley 1987). More specific training including similar techniques and involving the areas of cue attendance and hypothesis generation has also had significant effects in near-transfer measures. Subjects were reported to have developed an increased ability to describe and explain events similar to training situations (eg. Sieber and Lanzetta, 1966, Salomon and Sieber 1970, Wright 1978, and Pouler and Wright 1980). The effects remained significant in long term testing (Wright, 1981). Quality of hypotheses can be measured and hypotheses generation ability can be effectively taught (Salomon and Sieber 1970, Quinn 1971, Quinn and George 1975).

Use of intervention instruction involving prerequisite data gathering skills with teachers has been successful in improving ability to use probing questions in classroom discussions, giving clear and concise directions, in solving formal operational level problems and involvement of students in decision making (Orme 1977, Waksman et. al. 1978, Wright 1979, Martin 1983; Sunal, 1988). What is needed at this point is a study to determine the far-transfer effects of purposeful cognitive modification in prerequisite processes aimed at a specific formal thought schema, hypothetical - deductive reasoning, and applied to classroom teaching performance. The purpose of this investigation was to determine if intervention instruction in specific data acquisition

processes would transfer to increased basic skill performance in planning for classroom teaching.

The problem investigated in this study was to determine the effects of intervention instruction in cue attendance on novice teacher performance in analysis and modification procedures of classroom lesson plans. Included in the intervention instruction and followup lesson plan activities were detail attendance, information search questions, hypothesis generation and designing strategies for hypothesis testing.

The following research questions were examined on the effects of intervention instruction in cue attendance.

1. Does instruction affect perception and reporting of the number and type of appropriate data observed in analyzing problem events on film (near-transfer) or classroom lesson plans (far-transfer)?
2. Does instruction affect the perception and reporting of data related to appropriate description of variables in events. The outcome involved number, type and quality of questions asked and hypotheses constructed in analyzing problem events on film (near-transfer) or classroom lesson plans (far-transfer)?
3. Does instruction affect exploratory behaviors, inquiry pattern, and kind of data referenced in analyzing classroom lesson plans?
4. Does the ability of the teacher, cognitive functioning level, affect the results of the instruction in number, type or quality of the responses given in attempting to make decisions in problem situations?

PROCEDURE

Research Design

A modified Solomon four block design was used to investigate the effects of intervention training . The sample was randomly assigned to six groups, blocked 3 control and 3 experimental. Each block was given the same experiences except for the treatment variable. Pretesting in each block involved critique of a classroom lesson anecdote for one group, a Piagetian Task Assessment for a second group, and only introductory remarks for the third group. See Table I for the complete research design description.

[Insert Table I about here]

Sample

Participants in this research project consisted of 189 full time, final year university pre-service teachers. They were all secondary education majors. They were majoring in the social sciences, English, science or mathematics. The teachers attended a common class session dealing with classroom instruction during the year. On frequent occasions this class met for special topics in smaller groups.

A general description of the training session was given to the subjects during one class session. 175 students signed up for the activity and were assigned randomly to six groups. The research activity took place near the end of the academic year before students performed student teaching.

Treatment

The training activity experienced by the experimental group consisted of intervention instruction in cue attendance providing experience in each of the five previously described prerequisite cognitive process items. Decison-making situations typically require that one make a selection from among alternatives, internally or externally available, without having sufficient information to make an unequivocal choice. A second behavior set is possible where an individual does not comprehend the depth of a problem enough to want to seek new information. In the face of uncertainty the decision maker usually engages in various behaviors such as acquisition of information or reorganization of known information. These activities are seen as instrumental in reducing uncertianty and response conflict. Previous research beginning with Lanzetta (1963) has shown that the amount of effort devoted to information acquisition is related to the degree of response uncertianty generated by a problem, time pressures, and cost of information. The amount of conflict in the problem solver and the complexity of decision processes are a function of the response uncertainty, the importance of the problem and the conceptual structure of the decision maker. An optimal level of conflict provides maximum curiosity, learning, and cognitive restructuring. Conflict which is low or too high is not productive in bringing individuals into a mode of information search which efficiently solves problems (Sieber & Lanzetta, 1964). Conflict or confrontation becomes the learning tool which accomplishes cognitive resrtucturing and the basis for cognitive development (Bruner, 1966).

Intervention instruction in pre-decision information processing behavior produces increased uncertainty in responding to problems causing higher level conflict between possible

explanations or resolutions. A lack of uncertainty leads to simple, naive responses and few alternatives. The conflict is the subjective response uncertainty produced through a discrepancy between the novice's expectations and the information received or to be recalled from past experiences. This state of conflict is relieved by information search and by generating additional and more acceptable explanations or resolutions. The result of the conflict is increased exploratory behavior, curiosity, and information search. This increased exploratory behavior is performed to reduce the conflict to a tolerable level. Its strength depends on the strength of the response uncertainty.

Intervention instruction involves an increase in environment complexity sufficiently gradual to permit development of modes of cognitive functioning which can handle increased levels of information. Development here involves increased ability to differentiate, encode, and develop patterns in information leading to more effective pre-decision question asking and hypothesis generation behavior (Sieber & Lanzetta, 1970). Effective classroom teaching can be enhanced by consciously considering alternatives and by expanding the base for generating alternatives (Cooney, 1981).

For the purpose of administering intervention instruction, this study, as with past research, used complex, unstructured cues because they increase the number of possible response tendencies. The experimental group teachers were requested to describe from memory a difficult criterion number level of relevant details potentially useful in resolving a complex problem shown to them. As described and used in previous cue attendance research performed by Wright (1978), the filmed problem was one of Richard Suchman's (1966a) Inquiry Development Program filmloops published by Science Research Associates. The film consisted of discrepant events and was selected because of its abstractness.

The intervention instruction followed procedures which were determined reliable across several studies (Salomon , 1968; Salomon and Sieber, 1970; and Wright, 1979). An example of the activity was performed by the session instructor using a second Suchman filmloop "The Knife." A variety of details were reported after one showing of this 3 minute film. The 3 1/2 minute training film "The Balloon in the Jar" was then shown. Cues observed and remembered during the showing of the film by the subjects were reported and recorded only at the end of the showing. This was done until the subjects exhausted the number of cues seen and remembered. Then the film was shown again, followed by an additional recording session at the end. Repeated showings added details of cues observed to the original list. The film was shown as many times as required for the subjects to obtain the necessary criterion number.

The subjects were instructed not to attempt to explain why events were happening in the film or to give a response which could not be observed directly in the film. Duplicate details given were not counted. Only details actually observable in the film were counted toward the criterion level. Appropriate responses were reinforced for each reported cue. Groups of six to eight subjects were trained at one time and monitored by the instructor and research assistants. The instructor directed the film showings and verified the detail counts. The assistants were

individually trained and used scripts to give instructions and respond to questions.

The control group during this time period received instruction in designing lesson plans. Lesson outlines and examples were given illustrating basic lesson components and their relationships. Following this activity groups of 6 to 8 were each given practice activities. Samples of short Computer Assisted Instruction (CAI) lessons were shown and discussed. The problem given to subjects was to outline a lesson plan from which the CAI lesson was originally programmed. Lesson results were discussed with the groups. Lesson content consisted of English sentence structure, percentage mathematics problems, or simple physical science relationships. Instruction time for both experimental and control group activities was about one and one half hours, enough for all subjects to complete tasks.

Instruments

Pre-treatment measures consisted of a "Critique of a Classroom Lesson Activity" and the Lawson (1978) "Classroom Test of Formal Operations". The Critique of a Classroom Lesson Activity (CLA) consisted of a written 3 page ancedote describing a classroom lesson concerning the teaching of a concept to secondary school students. After reading the anecdote, the sheets were taken up and a question sheet was given to each subject. One open ended question was asked. It asked, "Give details of the lesson activity. Only give details actually described as taking place in the activity. You are not expected to attempt to explain why events are happening in the lesson. Write as many details as possible." An example of a typical response was given before the subjects answered the question.

The Classroom Test of Formal Operations was given to groups of 6 to 8 through live demonstration. Subjects wrote responses to questions and rationales for their answers as described by Lawson (1978).

Post-treatment measures consisted of "Detail Attendance" and "Critique of a Classroom Lesson Plan". Detail Attendance (DA) consisted of the Suchman Inquiry Development Program filmloop titled "Pendulums" and a response sheet for listing details. The filmloop was shown and then subjects were asked to write as many details as they could which actually occured in the film. The DA was given to determine the immediate treatment effect on similar activities, near-transfer effects.

The Critique of a Classroom Lesson Plan (CLP) posttest was given to all 6 groups one week after the treatment session. The CLP was planned to determine far-transfer treatment effects in a professional area of classroom teaching. This posttest involved reading a detailed lesson plan and, when completed, returning the plan and writing answers to a set of four open ended questions. The plan concerned lessons which described goals, prerequisites, objectives, materials, instructional procedures, and evaluation methods leading toward teaching a concept. The lesson plans were modeled after samples used in the methods courses. The lessons demonstrated the sequence and form of the process of concept formation (Bruner, 1961). The first question asked of the subjects was similar to the question in the CLA Pretest. This question is designed to test prerequisite processes, data gathering skill items one, two and five outlined earlier. Three

additional open-ended questions were asked for responses. These questions were designed to test prerequisite processes three and four, with some overlap on the three other items.

2. Give as many questions as you can about what you have read. State them so that they ask only for known facts, not inferences or conclusions. They must be stated so they can be answered either with a yes or no followup response. Any other type of question will not be answered.
3. Give as many hypotheses (explanations) as you can to explain what you have read in the lesson plan. The hypotheses should appropriately explain lesson plan components, events, and statements or relationships between them. (Hint, consider results produced if changes were made).
4. Design a test of <u>one</u> of the hypotheses (explanations) given about the lesson plan to determine if the hypothesis, which you made, should be accepted or rejected.

A response example was given for each of the questions asked. The subject was given the lesson plan to be reviewed as many times as needed to develop answers for the questions. The lesson plans were not available for observation during the written response time.

<u>Analysis</u>

The data from the instruments was coded following sequences described by Lawson (1978), Wright (1975), and Suchman (1966b). Lawson described a procedure for interpreting each student answer and rationale. In addition, to check the validity of these groups results, 29 students were individually orally interviewed using six Piagetian tasks similar to those found on the Lawson group test. Correlation between the two tests given points for each cognitive level obtained was 0.94.

Wright describes procedures for counting details, questions, and hypotheses. Content differences in statements were added to the counting procedure. Quinn's Hypothesis Quality Scale was used to determine the quality of the hypotheses for questions three and four (Quinn and George, 1975). This data was selected to correlate with the five data acquisition items earlier described.

Categories of questions given by the subjects were also analyzed, as described by Suchman (1966b), to determine the diversity in the types of inquiry patterns and kinds of data sources used. This was done in order to determine changes which might have taken place in planned and systematic exploratory prerequisite skills, data acquisition items two and three above. Suchman defined inquiry patterns as seeking Verification, verify some aspect of an event; Experimentation, ascertain the consequence of a change; Necessity, aspect of event or object necessary for the given result to be obtained; and Synthesis, whether the idea was valid. These four types of inquiry patterns can each use any of four kinds of data as information sources. The kinds of data involve, Events, Objects, Conditions, and Properties. Univariate and multiple analyses of variance were

used to assess the equivalency of groups. The level of significance accepted in all analyses was 0.05.

RESULTS

The pretest means of the two groups were similar for the Critique of the Classroom Lesson Activity and higher for the control group on the Classroom Test on Formal Operations. See Table II for main pretest results. Since the pretest groups were chosen at random, differences would have implications for the study as a whole. Each pretest was analyzed by total score and part score. Thus, reported details, questions, and hypotheses were compared on the lesson activity and total and individual item scores on the formal operations test. No significant statistical differences were found between the groups on the pretests.

Results from the Detail Attendance posttest showed a significantly higher ($F=236$, $P<.01$) number of details were reported by the experimental group, as compared to the control group. See Table 2 for summary report of DA results. Immediate and near-transfer effects were evident. Effects were found in a practical and statistical sense.

The delayed posttest results from the Critique of Classroom Lesson Plan showed higher experimental group mean scores in each question area, 1) number of details, 2) number of questions, and 3) number of hypotheses. Table 2 lists summary data for number of details described. The experimental group reported a significantly greater number of details ($F=4.61$, $P=.04$) on the lesson plan, 36% greater, than groups not given instruction in the cue attendance. Each of the three experimental subgroups reported significantly greater numbers of details than each of the three control subgroups.

[Insert Table II about here]

The total of 2229 appropriate details described by the subjects were categorized by content type. The experimental groups reported a significantly greater number of details describing processes observed in the lesson plan ($F=9.28$, $P\leq.01$) and a greater number of statements not classified as details about the plan ($F=5.85$, $P=.01$). Details described about objects in the lesson were similar in the two groups. Table III gives a breakdown of summary statistics from the CLP instrument for all of the effect areas.

The number of questions asked in analyzing the lesson plan differed between the groups. The experimental groups reported 48% more questions, a significantly greater amount ($F=4.95$, $P=0.03$) than the control group. The experimental groups reported significantly more questions of the type concerned with methods/processes to be used by the teacher and students ($F=8.12$, $P<.01$). No difference was noted in number of questions of the type which deal with content of the lesson or in the number of statements given which were not appropriate questions.

Subjects had difficulty giving hypotheses to explain lesson plan components, events, and relationships. An average of about three hypotheses was given by the experimental groups trained in cue attendance. This was significantly higher than the control group ($F=3.83$, $P=.05$). All hypotheses, a total of 353, were evaluated for quality, using the Quinn (1971) scale. The quality

of the hypotheses and the number of statements given which were non-hypothesis were not statistically different between the two groups.

[Insert Table III about here]

The types of inquiry patterns and data searching styles, representing exploratory behavior, as defined by Suchman (1966b) were determined by analyzing subject questions on the pretest lesson activity and posttest lesson plan. All subject questions, a total of 1994, were categorized twice into one of four categories. Question inquiry patterns given on the CLA pretest produced nearly equal means and non-significant statistical differences between the sampled groups. The same request for questions on the CLP posttest resulted in larger experimental group scores in all four inquiry pattern areas. Multiple analysis of variance run on all types of questions ($F=1.71$, $P=.14$) and with kinds of data sources ($F=6.19$, $P=.01$) found subjects instructed in cue attendance had roughly similar inquiry patterns but used data sources in a significantly different way from untrained subjects. Only the experimental group mean for the Verification question pattern of 7.0, was significantly larger than the control mean of 5.0, ($F=3.88$, $P=.05$). The data sources accessed for the questions were more evenly spread among the four categories for subjects receiving intervention instruction. Only one category was significantly different between the groups, the use of conditions of objects or events as a data source ($F=14.37$, $P<.01$). The experimental group accessed this source 40% of the time, mean of 3.0, as against 18%, mean of 0.91 for the control group.

One additional analysis was conducted to determine the effect of the level of cognitive functioning of subjects may have had on the intervention instruction and followup reporting in the treatment group. Data from the pretest "Classroom Test of Formal Operations" was used to construct a stratified subgroup of 28 subjects. A trend toward higher means was found with lower cognitive level subjects in most outcome areas of the CLP posttest. One was statistically significant, number of details about objects described in the lesson plan. Concrete subjects reported 5.7 details of objects in the lesson plan as against 2.1 and 1.9 for the transitional and formal students ($F=9.18$, $P<.01$). Formal cognitive level subjects reported higher means in one area, number of details about processes.

CONCLUSION AND IMPLICATIONS

Intervention instruction in cue attendance effected changes in secondary pre-service teachers' perception and reporting of problem situations in number, type, and quality of details; number and type of questions, and number of hypotheses. Significant results occurred both in near and far-transfer situations. These changes resulted in increased ability in hypothesis generation. For this sample of teachers there was a direct effect of purposeful training in prerequisite processes, aimed at more effective hypothetical-deductive reasoning, applied to basic skill performance in planning classroom teaching.

Intervention instruction also affects the kind of data referenced by sample teachers in developing responses. These results supported a change in the exploratory behaviors of subjects, increasing the diversity in use of all categories of data sources and maximizing one, Condition, which is of

significance in hypothesis generation. Previous research work reported similar results with non-teacher groups (Suchman, 1966b; Salomon and Sieber, 1970; and Wright, 1978). The growth from hypothesis scanning, unsystematically asking a series of questions testing specific unrelated hypotheses, to constraint seeking, systematically elimatinating sets of possible alternatives with each question, is a develpomental process which can be affected through training in transitional thought level subjects (Mosher and Hornsby, 1966).

The significant narrow focus of low ability subjects in reporting detail of objects, to the moderate exclusion of process detail, is an important finding. Such performance can lead to unsystematic exploratory behavior or a narrowness in considering alternative lesson planning approaches for making instructional decisions. Efforts at refocusing subject reflection to processes during intervention may moderate this tendency.

The neutral effect of intervention instruction on hypotheses quality is of interest. The stimulation of conflict and response uncertainty was not enough to create better hypotheses. In future research, integration of this instruction with hypothesis generation training and teacher education methods may effect changes needed for higher quality and effective analysis of lesson plans.

The ability level of the sample teachers, in general, did not significantly affect the results of the instruction. It appears that low cognitive level subjects profited at least as much, and usually more, from cue attendance instruction as higher level subjects. Salomon and Sieber (1970) and Wright (1978) reported similar results. Both studies in near-transfer situations reported a higher number of details, lower number of questions, and lower hypothesis quality for high ability level subjects resulting from cue attendance instruction. It was proposed by Salomon and Sieber that, due to the concreteness of cue attendance training, higher reasoning ability adults work under a strain in avoidance of the use of abstract representations. This leads to little or negative benefit for subjects.

It was hypothesized that cognitive deficiencies, as defined in this study, affected the way these sample teachers reacted to information presented to them. Intervention instruction aimed at cognitive modification in specific hypothetical - deductive reasoning prerequisite processes produced significant positive changes in these deficiencies with immediate impact on teacher perception and behavior during lesson plan analysis and evaluation. These results may provide a more detailed and meaningful understanding to the problem of teacher education leading toward teacher effectiveness. The results are in agreement and help interpret the meaning of a number of other studies which have attempted to look at the problem from a global or broad viewpoint. These previous studies found general cognitive functioning related to specific planning behaviors (Nelson and Ankay, 1977, Peterson, Marx and Clark, 1978, and Sunal, 1980) or to general teaching behaviors (Orme, 1977, Waksman et. al., 1978, Martin, 1983, and Sunal and Sunal, 1985). Results of other supportive studies concluding that the act of teaching itself enhances cognitive abilities (Murray, 1983), that successful teachers have "withitness" and "attention overlap" (Kounim, 1970), and "vigilance" effects (Buckner and McGrath,

1963) are equally unfocused in not relating specific variables of practical use in teacher education.

Intervention instruction in prerequisite cognitive processes has demonstrated short-term effects in classroom planning effectiveness. Latent effects of changing operational schema is another possible and long term alternative for increasing effectiveness. The control group received direct instruction in lesson planning and yet performed significantly lower in recognizing details, selecting variables, and general exploratory behaviors in analyzing lesson plans. The efficiency of teacher education activities may be increased through integration of intervention instruction in this sample of teachers. Receptivity of concepts and application proficiency can potentially benefit when objectives involve constructing and modifying lesson plans for daily teaching tasks. Greater ability in perception of lesson details, accessing memory, selection of variables, development of alternative possibilities, and decision making in the complexity of lesson plan writing are reasonable outcomes for this sample of teachers through intervention cognitive modification procedures.

The implications of the study are that alternative instructional procedures for more effective classroom lesson planning are possible. The results of this study place in perspective the cognitive complexities which teachers have to deal with in classroom teaching, especially with regard to decision making and application of teaching skills in planning, teaching, and evaluating lessons. As Piaget described in Science of Education and Psychology of the Child (1973), "the more we try to improve our schools, the heavier the teacher's task becomes; and the better our teaching methods, the more difficult they are to apply." Thus, teacher effectiveness does not simply relate to being exposed to, or understanding the content provided in, teacher education programs and workshops. It involves, in addition, the consistent use of higher level thought processes in everyday classroom planning and teaching.

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TABLE I

Intervention Instruction Research Design

Group	N	Activity				
		Pretests		Treatment	Posttests	
		Classroom test of Formal Operations	Critique of lesson activity	Cue Attendance Instruction	Detail Attendance using film (same day)	Critique of lesson plan (one week later)
Experimental						
R_1	30			X_1	0_3	0_4
R_2	28	0_1		X_1		0_4
R_3	30		0_2	X_1		0_4
Subtotal	88					
Control				Lesson Plan Instruction		
R_4	30		0_2	X_2		0_4
R_5	28			X_2	0_3	0_4
R_6	29	0_1		X_2		0_4
Subtotal	87					
TOTAL	175					

TABLE II

Summary Table Giving Group Means, Standard Errors, and

Anova Results Between the Two Treatment Groups

Group	N	Pretests		Posttests	
Experimental		Classroom test of Formal Operation (0_1)	Critiique of Lesson Activity (0_2)	Detail Attendance (0_3)	Critique of Lesson Plan (0_4)
		Mean (S.E.)	Mean (S.E.) # Details	Mean (S.E.) # Details	Mean (S.E.) # Details
R_1	30			48.5 (1.71)	15.3 (.61)
R_2	28	8.8 (.51)			14.6 (.69)
R_3	29		10.8 (.64)		13.8 (.65)
	—				———
Subtotal	87				14.58 (.64)
Control					
R_4	30		10.0 (.69) [F = 0.21]		10.6 (.55)
R_5	28			16.3 (1.11) [F = 236.2]*	10.5 (.62)
R_6	30	9.9 (.65) [F = 3.28]			11.2 (.68)
	—				———
Subtotal	87				10.9 (0.64) [F = 4.61]*
TOTAL	175				

*Difference between experimental and control groups significant at the $P \leq .05$ level using anova statistics

TABLE III

Effects of Intervention Instruction on Critique of Classroom Lesson Plan

Performance on Post Test	Group			
Critique of Classroom Lesson Plan (CLP) (0_4)	Control Group (N=87)		Treatment Group (N=88)	
	mean	standard error	mean	standard error
1. Number of details described about lesson plan	10.87	0.33	14.58*	0.57
a. Number of details about objects and events described in the plan	3.70	0.22	3.31	0.35
b. Details about processes described in the plan	7.17	0.32	11.27**	0.42
Statements given which were not details in the plan	2.87	0.25	5.15**	0.75
2. Number of questions asked about lesson plan	5.13	0.33	7.52*	0.35
a. Number of questions about methods used by students or teacher in the plan	4.75	0.35	6.65**	0.34
b. Questions about content of plan	0.39	0.24	0.88	0.29
Statements given which were not questions	0.48	0.12	0.42	0.08
3. Number of hypotheses given to explain what was observed in the lesson plan	1.23	0.14	2.68**	0.31
Hypotheses quality	4.05	0.12	3.85	0.15
Number of statements given which were not hypotheses	2.83	0.31	2.65	0.26

*Significantly different from control group at $P \leq .05$ using manova statistics

**Significantly different from control group at $P \leq .05$ using anova statistics